APPENDIX D
Urban and Agricultural Demand Projections

DEMAND ASSESSMENTS AND PROJECTIONS

Demand assessments for 2000 and projections for 2025 were made for the following water use categories:

1) Public Water Supply
2) Domestic Self-Supply and Small Public Supply Systems
3) Commercial/Industrial Self-Supply
4) Recreational Self-Supply
5) Thermoelectric Power Generation Self-Supply
6) Agricultural Self-Supply

Water demand projections through the year 2025 included analyses under average rainfall conditions and 1-in-10 year drought conditions. These projections are based on current trends and circumstances. Projections should therefore be understood as best estimates based on current knowledge of production, market and growth trends. The projections are not constrained by supply availability or demand management (conservation). Therefore, there is the opportunity to reduce these projected demand levels through policies and activities.

Of the six use categories listed above, categories 1 through 4 use population as an independent variable for projection purposes. Population estimates by county came from the U.S. Bureau of the Census 2000. Medium range county population projections published by the University of Florida Bureau of Economic and Business Research (BEBR 2004) were used for the 2025 time horizon. Some adjustments to the public water use estimates were made based on subsequent discussions with the individual service providers.

The Agricultural Field Scale Irrigation Requirements Simulation (AFSIRS) model was used to estimate demands for agricultural and recreational uses. Irrigation requirements were calculated for average and 1-in-10 year droughts. Irrigation requirements are equal to the difference between evapotranspiration and effective rainfall. Effective rainfall is equal to the rainfall that is stored in the plant root zone. Changing rainfall levels and timing therefore affect irrigation requirements. However, observed demand levels will vary based on irrigation managers' perceptions and responses to changing rainfall patterns. Realistically, some may allow plants to experience some level of stress before changing irrigation schedules, while other managers may habitually over water at a level that satisfies irrigation demands even during drought events.

For agricultural and recreational irrigation demands, the 2000 assessed and 2025 projected irrigated acreages were applied to the average and 1-in-10 year drought demand rates at the appropriate rainfall station and general soil type.

For public water supply and domestic self-supplied demands, the 2000 demand per capita rates were considered to represent the drought level demand rates (per capita). These demand rates were applied to the relevant projected populations. Projected average demands were reached by subtracting 6 percent (based on consultations with FDEP).

Average and 1-in-10 Rainfall

An average rainfall year is defined as a year with rainfall equal to the mean annual rainfall for the period of record. A l-in-10 year drought condition is defined as below normal rainfall with a 90 percent probability of being exceeded over a 12-month period. This means there is a 10 percent chance that less than this amount will be received in any given year. Section 373.0361(2)(a)l, F.S. states the level of certainty planning goal associated with identifying demands shall be based on meeting demands during a l-in-10 year drought event.

CATEGORIES OF WATER USE

(l & 2) Public Water Supply and Domestic Self-Supplied Demands

Public water supply (PWS) and domestic self-supply (DSS) demand assessments and projections were developed for 2000 through 2025. The domestic self-supplied category includes small public supply systems with projected demands of less than 0.1 million gallons per day (MGD) in 2025, as well as residents that supply their own water needs. Self-supplied residents may be within utility service area boundaries or outside of these boundaries. Water demands were forecast by multiplying population projections by per capita water use rates. Per capita water use rates were calculated based on 2000 population data from the U.S. Bureau of the Census (2000) and the water production reported for each utility by the U.S. Geological Survey (USGS 2003). The population projections for 2025 for each county were based on the medium range forecasts published by the University of Florida Bureau of Economic and Business Research (BEBR 2004).

The 2000 and projected 2025 utility-served areas used in this analysis were obtained from the utilities. Adjustments were made to account for the known future expansion of the current served areas. It was assumed that all projected population growth within areas being served by a utility would be connected to that PWS system. The proportions of populations within utility-served areas into public water supplied and domestic self-supplied categories were modified in several instances based on utility input.

Per Capita Rates

Per capita water use rates for 2000 for each utility were calculated by dividing raw water pumped by the permanent resident population served by PWS utilities. The U.S. Geological Survey and the South Florida Water Management District (SFWMD or District) pumpage reports provided raw water withdrawal data. Total population and the number of individuals served by the utilities were determined by the above-mentioned methodology.

These per capita rates include total use, incorporating use by seasonal residents and tourists, commercial and industrial utility supplied use, and the losses incurred in water delivery, in addition to the use by permanent residents. Irrigation demand for PWS served households using private well water for their landscape irrigation was not assessed due to lack of available data.

The year 2000 was considered as a drought year that was slighter greater than a 1-in-10 year drought level of recurrence. For this reason, per capita rates for 2000 were used to develop the 1-in-10 year drought 2025 utility demand projections. Adjustments were then made to these projections to normalize them for average rainfall conditions. Per capita rates used in the demand projections were not adjusted for additional conservation efforts beyond the 2000 level.

Domestic self-supply per capita rates within public water supply utility-served area boundaries were assumed the same as for the utility serving that service area. The per capita rates for the domestic self-supplied users in areas not served by public utilities were assumed the weighted average of the public water supply per capita rates for the county.

PWS and DSS Average and l-in-10 Year Drought Adjustments

Indoor use categories need no adjustment from the 2000 (drought) observed values to an average year, as these categories would have no demand shifts related to drought. Unadjusted base demand for a utility was projected by multiplying a base year per capita rate by a projected population. If desired, the withdrawal distribution (by month) can be derived from historical demand curves for the utility. The difference between the monthly demand for the base year and the unconstrained demand for an average year, or a l-in-10 year, will directly depend on the changes in the outdoor use, specifically, changes in demand for landscape irrigation. If the base year is an average year, then there is no need for an adjustment from base to average. However, if the base year is significantly wetter or drier than average, then unconstrained demands for outdoor use will adjust proportionally.

Population Served

2000 Population

U.S. Census data were used as the basis for the 2000 population and the distribution of that population. Block level information from the census count was used as the basic unit of analysis. Total population, occupied housing units and persons per occupied housing unit were retrieved from census data. In the absence of a self-supplied unit count in the 2000 Census, the self-supplied population within utility-served areas was taken as a constant based on the 1990 Census (which included household water source on its long form).

The geographic areas represented by the census blocks and the utility-served areas were input as polygon layers into the SFWMD Geographic Information System (GIS). The two layers were overlaid to determine if census blocks were inside or outside the area served by each utility. Imagery was used to review decisions when necessary. Population assessments of public water supply served and domestic Self-supplied were then calculated. The populations for each utility-served area were then totaled.

2025 Population Projections

The medium range county projections as published by the Bureau of Economic and Business Research (BEBR 2004) were used as county population projection control totals for 2025. The geographic distribution of the 2025 population was assessed using the ratio of traffic analysis zone population growth for the areas covered by traffic analysis zones. The geographic distribution of the 2025 population for areas not covered by traffic analysis zones was based on the population distribution in the 2000 census block data. Total county population was limited to the county total from the BEBR medium range projections.

The two layers were overlaid to determine if traffic analysis zones were inside or outside the area served by each utility. Population estimates were then recalculated for the new attribute by deciding which polygons were inside or outside of utility-served boundaries. The populations for each utility-served area were then totaled and limited not to exceed the BEBR medium range population projection for each county.

Any growth in population within an area being served by a utility was assigned to that utility. This means that within utility-served areas, the domestic self-supplied population was assumed to remain the same from 2000 to 2025. Any growth in population within an area not planned to be served by a utility was assigned to the domestic self-supplied category. **Table 1** provides the 2000 and 2025 population changes by county for public water supply and domestic self-supplied users. **Table 2** and **Table 3** show the current and projected 1-in-10 year drought water demand by county and utility supplier for those counties within the KB Planning Area. Water use in **Table 3** includes use within the KB Planning Area and some portions of water use in Orange County

supplied by Orange County Utilities and the Orlando Utilities Commission. This additional water use is identified as St. Johns River Water Management District (SJRWMD) demands in **Table 3**.

Table 1. Population Estimates by County for the Public Water Supplied and Domestic Self-Supplied Demand.

2000					
County	**Countywide Population**	**SFWMD Portion**	**SFWMD PWS Population**	**DSS Population**	
Glades*	10,576	3,665	2,529	1,136	
Highlands	87,366	7,636	1,722	5,914	
Okeechobee*	35,910	33,321	19,742	13,579	
Orange	896,344	220,065	216,508	3,557	
Osceola	172,493	171,416	152,180	19,236	
Polk	483,924	14,518	6,752	7,766	
Total	1,686,613	450,621	399,433	51,188	
2025					
County	**Countywide Population**	**SFWMD Portion**	**SFWMD PWS Population**	**DSS Population**	**% Change SFWMD 2000–2025**
Glades*	14,300	4,956	3,324	1,632	35%
Highlands	123,500	10,794	2,168	8,626	41%
Okeechobee*	46,400	43,055	28,557	14,498	29%
Orange	1,542,400	513,619	488,657	24,962	133%
Osceola	525,000	517,000	495,752	21,248	202%
Polk	694,200	20,826	9,307	11,519	43%
Total	2,830,500	1,110,250	1,027,765	82,245	153%

* Portions of population within Kissimmee Basin Planning Area only.

Table 2. Public Water Supplied and Domestic Self-Supplied 1-in-10 Demand Projections by County.

2000				
County	**SFWMD Total Demand (MGD)**	**SFWMD PWS Demand (MGD)**	**DSS Demand (MGD)**	
Glades	0.60	0.39	0.21	
Highlands	1.27	0.23	1.04	
Okeechobee	4.92	2.46	2.46	
Orange	86.22	84.85	1.37	
Osceola	38.64	34.90	3.74	
Polk	4.55	2.07	2.48	
Total	136.20	124.90	11.30	
2025				
County	**SFWMD Total Demand (MGD)**	**SFWMD PWS Demand (MGD)**	**DSS Demand (MGD)**	**% Change Total Demand 2000–2025**
Glades	0.68	0.47	0.21	13%
Highlands	1.72	0.31	1.41	35%
Okeechobee	6.65	4.15	2.50	34%
Orange	151.03	147.53	3.50	73%
Osceola	99.30	94.97	4.33	169%
Polk	8.00	4.33	3.67	76%
Total	267.38	251.76	15.62	96.3%

Table 3. Public Water Supplied and Domestic Self-Supplied 1-in-10 Demand Projections by Utility.

Utility	Estimated Daily Flow (MGD)	Projected Average Daily Flow (MGD)					% Change
	2000	2005	2010	2015	2020	2025	2000–2025
Glades County							
Brighton Public Water System	0.39	0.41	0.42	0.44	0.45	0.47	20.5%
Domestic Self-Supplied	0.21	0.21	0.21	0.21	0.21	0.21	0.0%
Highlands County							
Spring Lake Development	0.23	0.25	0.26	0.28	0.29	0.31	34.8%
Domestic Self-Supplied	1.04	1.11	1.19	1.26	1.34	1.41	35.6%
Okeechobee County							
Okeechobee Utility Authority	2.34	2.68	3.02	3.35	3.69	4.03	72.2%
Okeechobee Correctional	0.32	0.32	0.32	0.32	0.32	0.32	0.0%
Domestic Self-Supplied	2.46	2.50	2.50	2.50	2.50	2.50	1.6%
Orange County							
Orange County Public Utilities							
Alternative Supply Offset[2]	3.01	5.25	7.00	8.28	19.00	32.40	976.4%
SFWMD Portion	15.12	19.25	23.50	28.50	29.75	29.75	96.8%
Orlando Utilities Commission							
Alternative Supply Offset	0	5.20	6.90	7.80	10.00	10.01	
SFWMD Portion	40.65	49.50	56.40	60.10	60.20	60.20	48.1%
Reedy Creek Imp. District							
Alternative Supply Offset[1]	6.10	6.30	6.50	6.80	7.00	7.20	18.0%

1. Utility specified reclaimed source to meet potable demand unless otherwise specified – reclaimed calculated at 60% potable demand.
2. Includes 10.80 MGD (at 60%) reclaimed and 21.60 of unspecified source in 2025.
3. Includes 3.60 MGD reclaimed and 4.00 MGD (at 60%) surface water from Shingle Creek.

Table 3. Public Water Supplied and Domestic Self-Supplied 1-in-10 Demand Projections by Utility (Continued).

Utility	Reported Daily Flow (MGD)	Projected Average Daily Flow (MGD)					% Change 2000–2025
	2000	2005	2010	2015	2020	2025	
Groundwater	19.70	20.44	21.18	21.92	22.66	23.40	18.8%
Taft Water Association	0.27	0.29	0.30	0.31	0.32	0.33	22.2%
Domestic Self-Supplied	1.37	1.80	2.22	2.65	3.07	3.50	155.5%
Osceola County							
Toho Water Authority							
Alternative Supply Offset[3]	3.6	3.60	6.00	6.00	6.00	6.00	66.7%
City of Kissimmee	21.87	29.46	37.05	44.63	52.22	59.81	173.5%
Florida Water Services	2.34	2.73	3.12	3.51	3.90	4.29	83.3%
Poinciana Utilities (Osceola)	1.76	3.01	4.27	5.52	6.78	8.03	356.3%
St. Cloud	3.29	4.61	5.93	7.26	8.58	9.9	200.9%
Alternative Supply Offset[3]	1.7	2.68	3.66	4.64	5.62	6.6	288.2%
Siesta Lago MHP	0.22	0.22	0.22	0.22	0.22	0.22	0.0%
Tropical Palms Resort	0.12	0.12	0.12	0.12	0.12	0.12	0.0%
Domestic Self-Supplied	3.74	3.86	3.98	4.09	4.21	4.33	15.8%
Polk County							
Poinciana Utilities (Polk)	1.57	1.67	1.77	1.87	1.97	2.07	31.8%
Oakhill Estates (Polk Utility)	0.45	0.69	1.20	1.44	1.68	2.01	346.7%
Westgate River Ranch	0.05	0.12	0.21	0.25	0.25	0.25	400.0%
Domestic Self-Supplied	2.48	2.72	2.96	3.19	3.43	3.67	48.0%
Kissimmee Basin Total	136.20	158.8	187.1	209.1	236.8	267.4	100.5%

1. Utility specified reclaimed source to meet potable demand unless otherwise specified – reclaimed calculated at 60% potable demand.
2. Includes 10.80 MGD (at 60%) reclaimed and 21.60 of unspecified source in 2025.
3. Includes 3.60 MGD reclaimed and 4.00 MGD (at 60%) surface water from Shingle Creek.

In addition to the public water use numbers provided in **Table 3**, both Orange County Utilities (OCU) and Orlando Utilities Commission (OUC) operate facilities within the SJRWMD that deliver water to the SFWMD and vise versa. In 2000 OCU withdrew 33.82 MGD from SJRWMD permitted facilities, and OUC withdrew 60.31 MGD. By 2025 these demands are expected to increase to 55.25 MGD for OCU and 55.40 MGD for OUC for SJRWMD permitted facilities. In addition, by 2015 OUC is proposing to arrange for delivery of 11.10 MGD of reclaimed water to meet a portion of their and other growth demands by 2025. Only a small portion, if any, of this reclaimed water is projected to be delivered to facilities within the SFWMD.

(3) Commercial/Industrial Self-Supply

This category includes self-supplied commercial and industrial demands not supported by a public utility. Water used for commercial and industrial purposes supplied by utilities is included with other utility demands. Predominant types of employment found in the SFWMD were evaluated by employment sector to determine whether these employment types could be anticipated to grow at the same rate and in the same direction as the population. In the SFWMD, the majority of the employees are found in the service and retail sales sectors, indicating that water demand by these sectors will generally grow along with the population. Demand for this category of water use was projected to grow at the rate of each county's population growth. Demands for commercial and industrial are not estimated to change between average and 1-in-10 year drought demand conditions. **Table 4** summarizes Kissimmee Basin Commercial and Industrial demand projections; 2000 use was assessed from SFWMD water use permits.

Table 4. Commercial and Industrial Self-Supplied Demand (MGD).

County Area	2000	2005	2010	2015	2020	2025
Southern Orange	6.33	7.92	9.51	11.10	12.69	14.28
Western Osceola	0.32	0.38	0.44	0.49	0.55	0.61
Eastern Polk	0.05	0.06	0.07	0.08	0.08	0.09
Eastern Highlands	3.15	3.43	3.71	3.99	4.28	4.56
Western Okeechobee	3.98	4.21	4.45	4.69	4.93	5.17
Total MGD	13.83	16.00	18.18	20.35	22.53	24.71

(4) Recreation Self-Supply

The recreational self-supplied demand category includes self-supplied irrigation demands for large landscaped and recreational areas (as opposed to private homes), and for golf courses, typically identified through consumptive use permits. Because of the data sources available, golf course demands by county are projected separately and added to the other landscape and recreation demands. Golf course irrigation is the largest recreational type of water use. Non-golf course landscaping and recreational water use was assumed to increase proportional to the county population, with 2000 used as the

base year. Recreational irrigation requirement estimates for average and l-in-10 year droughts were made using the AFSIRS model. The irrigation requirements were calculated similarly to other irrigation requirements, using a representative irrigation system/rainfall station/soil type combination for each county. Recreational self-supplied demand projections for landscape and golf acreage are shown in **Table 12**. Recreational demands supplied by public utilities are included in the PWS demands.

Landscape

Demand projections for this subcategory include irrigated acreage specifically identified for landscape and recreation in the District's consumptive use permitting database. This category excludes golf courses. Landscaped areas that are not identified in the water use permits are assumed included in the public water supply for utilities. Landscaping acreage was projected to increase proportionally to the county population, with 2000 used as the base year. Within the Kissimmee Basin during 2000, there were 700 acres of landscape self-supplied demand in the greater than 100,000 GPD category. **Table 5** outlines acreage projections for large-scale landscaping and recreation self-supplied usage.

Table 5. Landscape Self-Supplied Acreage.

County	2000	2005	2010	2015	2020	2025
Southern Orange	613	766	919	1,075	1,226	1,385
Western Osceola	24	28	32	36	41	45
Eastern Polk	16	23	30	37	44	51
Eastern Highlands	7	8	8	9	10	10
Northern Glades	10	11	12	13	13	14
Western Okeechobee	30	32	34	35	37	39
Total Acres	700	868	1,035	1,205	1,371	1,544

Golf Courses

Historical irrigated golf course acreage data were gathered from the District's consumptive use permitting database, the Golf Course Directory (National Golf Foundation 2001) and personal communication with staff from several of the golf courses listed. Irrigated golf course acreage projections were made by statistically correlating historical acreage to historical population, or to a time trend or to both. Projections were made for total irrigated golf course acreage. Those courses supplied by reuse or potable utility systems were identified and accounted for in the projections.

In 2000, there were 53 golf courses in the KB, of which 21 were self-supplied and 32 were irrigated with reclaimed water. The great majority of the golf courses (46) in the KB are in southern Orange and western Osceola counties. There are no golf courses currently in northern Glades County that are self-supplied, and none are projected. All projected courses are considered potentially self-supplied in this analysis; however, use of reclaimed water is encouraged.

Southern Orange County and Western Osceola County

Golf courses currently in Orange County and Osceola County are shown in **Table 6** and **Table 7**, respectively. As in other counties, the growth in golf course acreage has occurred irregularly on a year-by-year basis.

Using historic golf course construction as a baseline, a statistical model was applied to project irrigated golf course acreage in both southern Orange and Osceola counties (portions located within the SFWMD). All golf courses currently in Osceola County are within the SFWMD. An equation using a damped trend exponential smoothing model was estimated to project irrigated golf course acreage in both of these counties.

Irrigation requirements for projected self-supplied golf courses in southern Orange County and western Osceola County are shown in **Table 8**. Water demands created by future golf course expansion were considered self-supplied.

Table 6. Golf Courses in Orange County.

Name	Year Opened	SFWMD Irrigated Acres	SFWMD Self-Supplied Acres
Winter Park[1]	1916	0	0
CC of Orlando	1921	0	0
Dubsdread	1922	0	0
Rio Pinar	1958	0	0
Eaglewood GC	1958	332	332
Naval Training Center	1962	0	0
Bay Hill[1]	1964	180	0
Wedgefield[1]	1965	0	0
Winter Pines	1965	0	0
West Orange[1]	1967	0	0
Greens Golf[1]	1968	35	0
Cypress Creek[1]	1970	120	0
LBV Oak Trail Golf Club[1]	1971	58	0
Disney-Magnolia[1]	1971	160	0
Errol	1971	0	0
Deer Run[1]	1972	0	0
Fairways	1972	0	0
Lake Buena Vista[1]	1972	145	0
Rosemont	1972	0	0
Orange Tree[1]	1973	94	0
Sweetwater	1974	0	0
Zellwood Station	1974	0	0
Ventura[1]	1980	0	0
McCoy Annex	1981	30	30
Boggy Creek	1982	27	27

Table 6. Golf Courses in Orange County (Continued).

Name	Year Opened	SFWMD Irrigated Acres	SFWMD Self-Supplied Acres
Orange Lake	1982	238	238
Grand Cypress[1]	1983	477	0
Interlachen	1985	0	0
Meadow Woods[1]	1985	105	0
Hunters Creek[1]	1986	180	0
Isleworth[1]	1986	179	0
Lake Nona[1]	1986	161	0
Marriott's Orlando[1]	1986	95	0
Windemere[1]	1986	140	0
International[1]	1987	110	0
Metro West[1]	1987	109	0
Orangewood[1]	1987	138	0
Golf World	1988	0	0
Eastwood Golf Course	1989	120	120
Naval Training Center	1990	0	0
Bonnet Lakes	1991	145	145
Glenmuir	1993	512	512
Forest Lake[1]	1994	0	0
Eagle Pines[1]	1995	70	0
Osprey Ridge	1995	120	120
The Palms	1995	120	120
Exec. Nine	1995	30	30
Faldo Golf Institute	1996	80	80
Stoneybrook East[1]	1997	0	0
Orange County NGC[1]	1997	0	0
Rock Springs Ridge[1]	1998	0	0
Keene's Point[1]	1999	263	0
Lake Hart GC[1]	2000	96	0
Lake Orlando	2000	0	0
Total		4,669	1,754

1. Irrigated with reuse.

Table 7. Golf Courses in Osceola County.

Name	Year Opened	Irrigated Acres	Self-Supplied Acres
Kissimmee GC (Airport Inn)[1]	1965	100	0
Kissimmee GC[1]	1970	37	0
Buenaventura Lakes CC[1]	1975	65	0
Crystalbrook Golf Club	1973	18	18
Osceola Golf Club	1984	120	120
Kissimmee Oaks GC[1]	1985	158	0
Kissimmee Bay CC[1]	1990	85	0
Million Dollar Mulligan	1990	60	60
Falcon's Fire Golf Club (Saralago)[1]	1993	170	0
Celebration Golf Club[1]	1996	120	0
Remington Golf Club[1]	1996	102	0
The Palms (Tempus Palms, Mystic Dunes)[1]	1998	140	0
The Palms (Tempus Palms, Mystic Dunes)[1]	1999	24	0
Champions Gate Golf Resort[1]	2000	225	0
Total		1,424	198

1. Irrigated with reuse.

Table 8. Irrigation Requirements For Projected Self-Supplied Golf Courses In Southern Orange County and Western Osceola County.

County/Acreage/Demand	2000	2005	2010	2015	2020	2025
Southern Orange County						
Acreage	Acres					
Irrigated Acreage	4,669	5,161	5,648	6,155	6,678	7,211
Self-Supplied Irrigated Acreage	1,754	2,015	2,363	2,652	2,893	3,093
Net Irrigation Requirements	MGD					
During an Average Rainfall Year (17.9 inches)	3.12	3.58	4.20	4.71	5.14	5.49
During a 1-in-10 Drought Year (22.2 inches)	3.86	4.43	5.20	5.84	6.37	6.81
Western Osceola County						
Acreage	Acres					
Irrigated Acreage	1,424	1,851	2,333	2,812	3,290	3,765
Self-Supplied Irrigated Acreage	198	625	1,107	1,586	2,064	2,539
Net Irrigation Requirements	MGD					
During an Average Rainfall Year (20.5 inches)	0.40	1.27	2.25	3.22	4.20	5.16
During a 1-in-10 Drought Year (23.4 inches)	0.46	1.45	2.57	3.68	4.79	5.89

Other Kissimmee Basin Counties

With the exception of Orange and Osceola counties, there are relatively few golf courses in the Kissimmee Basin. Those existing in 2000 are shown in **Table 9** through **Table 11**. There are no golf courses in the Kissimmee Basin portion of Glades County. In these counties trend establishment is not realistic due to the small number of existing courses. In Highlands and Okeechobee counties there are no courses known to be planned and therefore no new acreage is projected. Development near the Orange–Polk County line since 2000 has shown very rapid growth including several new golf courses. In addition, future land use maps for northeast Polk County show a change from rural to residential development by 2020. For these reasons, it is anticipated that new growth in northeast portion of Polk County will grow rapidly and that two or three new golf communities will be constructed as part of this growth.

Table 9. Golf Courses in Eastern Polk County..

Name	Year Opened	Irrigated Acres	Self-Supplied Acres
Indian Lake Estates Golf	1964	71	71
Greenlefe	1972	15	15
Poinciana	1972	120	120
Sun Air	1976	80	80
Total		286	286

Table 10. Golf Courses in Eastern Highlands County..

Name	Year Opened	Irrigated Acres	Self-Supplied Acres
Placid Lakes CC	1966	90	90
Spring Lake G&CC[1]	1980	160	0
Total		250	90

1. Irrigated with reuse.

Table 11. Golf Courses in Western Okeechobee County.

Name	Year Opened	Irrigated Acres	Self-Supplied Acres
Okeechobee G&CC	1966	31	31
Okeechobee KOA (Crystal Lakes)	1968	57	57
Total		88	88

Recreation

Table 12 presents recreational self-supplied demand projections in the Kissimmee Basin.

Table 12. Recreational Self-Supplied Demand Projections in the Kissimmee Basin.

County/Acreage/Demand	2000	2005	2010	2015	2020	2025
Southern Orange						
Acreage	Acres					
Irrigated Golf Course Acres	4,669	5,161	5,648	6,155	6,678	7,211
Self-Supplied Golf Course Acres	1,754	2,015	2,363	2,652	2,893	3,093
Self-Supplied Landscape Acres	613	766	919	1,075	1,226	1,385
Irrigation Requirements	MGD					
Average Irrigation Requirement	4.20	4.94	5.83	6.62	7.32	7.95
1-in-10 Irrigation Requirement	5.21	6.12	7.23	8.21	9.07	9.86
Western Osceola						
Acreage	Acres					
Irrigated Golf Course Acres	1,424	1,851	2,333	2,812	3,290	3,765
Self-Supplied Golf Course Acres	198	625	1,107	1,586	2,064	2,539
Self-Supplied Landscape Acres	24	28	32	36	41	45
Irrigation Requirements	MGD					
Average Irrigation Requirement	0.45	1.33	2.32	3.30	4.28	5.25
1-in-10 Irrigation Requirement	0.52	1.52	2.64	3.76	4.89	6.00
Eastern Polk						
Acreage	Acres					
Irrigated Golf Course Acres	286	286	370	470	570	670
Self-Supplied Golf Course Acres	286	286	370	470	570	670
Self-Supplied Landscape Acres	16	23	30	37	44	51
Irrigation Requirements	MGD					
Average Irrigation Requirement	0.61	0.61	0.81	1.02	1.23	1.44
1-in-10 Irrigation Requirement	0.93	0.93	1.16	1.48	1.81	2.13

Table 12. Recreational Self-Supplied Demand Projections in the Kissimmee Basin (Continued).

County/Acreage/Demand	2000	2005	2010	2015	2020	2025
Eastern Highlands						
Acreage	Acres					
Irrigated Golf Course Acres	250	250	250	250	250	250
Self-Supplied Golf Course Acres	90	90	90	90	90	90
Self-Supplied Landscape Acres	7	8	8	9	10	10
Irrigation Requirements	MGD					
Average Irrigation Requirement	0.20	0.20	0.20	0.21	0.21	0.21
1-in-10 Irrigation Requirement	0.32	0.33	0.33	0.33	0.33	0.33
Northern Glades						
Acreage	Acres					
Irrigated Golf Course Acres	0	0	0	0	0	0
Self-Supplied Golf Course Acres	0	0	0	0	0	0
Self-Supplied Landscape Acres	10	11	12	13	13	14
Irrigation Requirements	MGD					
Average Irrigation Requirement	0.02	0.03	0.03	0.03	0.03	0.03
1-in-10 Irrigation Requirement	0.04	0.04	0.04	0.05	0.05	0.05
Western Okeechobee						
Acreage	Acres					
Irrigated Golf Course Acres	88	88	88	88	88	88
Self-Supplied Golf Course Acreage	88	88	88	88	88	88
Self-Supplied Landscape Acreage	30	32	34	35	37	39
Irrigation Requirements	MGD					
Average Irrigation Requirement	0.23	0.23	0.24	0.24	0.24	0.25
1-in-10 Irrigation Requirement	0.27	0.27	0.28	0.28	0.28	0.29

Table 12. Recreational Self-Supplied Demand Projections in the Kissimmee Basin (Continued).

County/Acreage/Demand	2000	2005	2010	2015	2020	2025
Acreage	Acres					
Total KB Recreational Acres (self-supplied landscape + self-supplied golf)	3,116	3,972	5,053	6,091	7,076	8,024
Irrigation Requirements	MGD					
Total KB Recreational Self-Supplied Average Irrigation Requirement	5.71	7.34	9.43	11.41	13.31	15.13
Total KB Recreational Self-Supplied 1-in-10 Irrigation Requirement	7.29	9.21	11.68	14.11	16.43	18.66

(5) Thermo Electric Power Generation Self-Supply

Thermoelectric power plants may withdraw large quantities of water for cooling purposes. The vast majority of this water is not consumed in the sense that the same water may pass through the plant repeatedly, sequentially circulating through a series of ponds. There will normally be some evaporative losses (mostly related to the cooling water being kept in ponds), which must be replaced from an external source beyond rainfall and runoff. The permitted supplemental withdrawal for thermoelectric power cooling (fresh water) was 0.46 MGD in 2000 or 0.3 percent of the overall urban water demand. This demand is expected to increase to 22.46 MGD or 8 percent of the overall urban water demand in 2025. The location of the demands in 2025 is pending per information from the utilities.

(6) Agricultural Self-Supply

Agricultural self-supply demand calculations for the 2005 KB Update were made using the Agricultural Field Scale Irrigation Requirement Simulation (AFSIRS) model. This is a change from the 2000 KB Plan, which used a modified Blaney-Criddle model to estimate supplemental requirements for irrigation.

The agricultural demand assessment involved establishing acreages through collecting data from the Florida Agricultural Statistics Service (FASS), GIS land use maps and the Institute of Food and Agricultural Sciences (IFAS). For counties only partially within the planning region, crop acreages were most often projected for the entire county and these projections apportioned. Unless inappropriate, this was done by assuming changes in acreage proportional to the most recently reported separation of acreage.

The techniques chosen to project crop acreages were those that were judged to best reflect the specific crop scenario in each county. This led to some variation in projection techniques between crop types and in method between counties. While it would have been ideal if a comprehensive functional form were used to produce tangible projections universally, no such form was found. The acreage projections developed here reflect a combination of methods; each deemed appropriate where used. This is consistent with the way in which crop acreage is projected by IFAS and other water management districts.

When no statistically valid trend was found, or any convincing empirical knowledge of future changes in a crop's acreage, then the specific crop's acreage was projected at its most recently reported value for future time horizons.

Average and 1-in-10 year drought irrigation requirements were calculated using the District's AFSIRS model. Historical weather data from the rainfall station considered to best represent the crop/county combination were used to calculate irrigation requirements.

A crop's net irrigation requirement is the amount of water used for evapotranspiration minus effective rainfall, while gross irrigation requirement includes both the net irrigation requirement and the losses incurred in getting irrigation to the crop's root zone. Irrigation efficiency refers to the average percent of total water applied that is stored in the plant's root zone. This relationship is expressed as follows:

Gross Irrigation Requirement = Net Irrigation Requirement / Irrigation Efficiency

Projections of irrigation system type, and the effect of the corresponding irrigation efficiencies, were based on the interpretation of current ratios and trends. There are three basic types of irrigation systems currently used in south Florida crop production. These are seepage (50 percent), sprinkler (75 percent) and microirrigation (85 percent) systems. The irrigation efficiencies estimated by the SFWMD are shown in parentheses.

Available water capacity and depth of soil have a direct effect on effective rainfall. An additional factor considered explicitly by the AFSIRS model, but combined with soil properties, is on-farm irrigation management strategy. The AFSIRS model, defines eight "generic" soil types representing the major kinds of soils found in Florida. All runs were made using the generic sandy soil as defined by the AFSIRS model.

Irrigated Crop Types

The irrigated commercially grown crop categories were based on the categories developed by the Water Demand Projection Subcommittee, made up of representatives from Florida's five water management districts. These categories are: 1) citrus, 2) other fruits and nuts, 3) vegetables, melons and berries, 4) field crops, 5) sod, 6) greenhouse/nursery, 7) pasture and 8) miscellaneous. Although all of these crops are grown commercially somewhere within the SFWMD, not all are grown in the Kissimmee

Basin. Crop acreage projections were initially made by District staff based on statistical trends, and then sent out and reviewed by the local IFAS extension offices (responses pending).

Citrus

All categories of citrus (oranges, grapefruit, tangerines, limes, etc.) were grouped together for projection purposes. Historical citrus acreage data were gathered from volumes of the Florida Agricultural Statistics Service Commercial Citrus Inventory (FASS 2002–2004a), which is published biennially.

Citrus is by far the dominant agricultural crop in the KB Planning Area, and occupies over 70 percent of the irrigated agricultural acreage in the region. Significant citrus acreage declines have been experienced in the northern areas of the KB (southern Orange, western Osceola and eastern Polk counties), while areas in the south of the KB (northern Glades, western Okeechobee and eastern Highlands) have had growth. Continued projected decline in citrus acreage in the north is somewhat offset by stability and increased acreage in the south, resulting in a slight projected overall decline in citrus acreage for the KB from 2000 to 2025. Declines in the north are largely the result of urban pressure and intermittent freezes combined with citrus market conditions.

Citrus acreage in the planning area is projected to decline from 52,164 acres in 2000 to 46,535 acres in 2025. This decline in acreage represents a decrease in average citrus irrigation requirements from 55.9 MGD in 2000 to 51.1 MGD in 2025. Acreage is projected to continue to decline more significantly in the northern portion of the planning area.

Other Fruits and Nuts

Within the SFWMD, non-citrus fruit crops (avocados, mangos, papaya, etc.) are produced commercially, but there is no significant production of these crops in the Kissimmee Basin.

Vegetables, Melons and Berries

Vegetable crops grown in the planning area include squash, cucumbers, peppers, tomatoes, watermelons, potatoes and Latin vegetables. Blueberries are also grown in Highlands County. Different types of vegetables are often grown interchangeably. In 2000, there were 12,890 acres of land used for vegetable, melon and berry production. This is projected to remain relatively constant through 2025, and represents an average irrigation requirement of 21.6 MGD. Information was provided from the SFWMD GIS land use maps.

Field Crops

Sugarcane is the only field crop with significant acreage in the KB. Glades and Highlands are the only counties in the KB Planning Area where sugarcane is grown commercially. In 2000, there were 3,338 acres of production, which were all in Glades County. Since 2000, there has been an expansion of about 2,100 acres, of which about 1,000 acres have been in Highlands County, and no further growth is anticipated. As a result of the cultivation practices used for sugarcane (ratoon and fallow), about 20 percent of the land used for sugarcane production is fallowed in any given year. This fallow land does not require irrigation and is not included in the demand projections presented here.

The 2000 production of 3,338 acres had an associated average irrigation requirement of 10.0 MGD in 2000, and based on the addition 2,100 acres that have been planted since 2000; projected demands are 15.3 MGD through 2025. Historical sugarcane acreage data were gathered from annual volumes of the Field Crops Summary (FASS 2002–2004b) and were used to provide statistical estimates of future production.

Sod

There is some variation in the production practices of sod within the Kissimmee Basin. Some harvested sod is irrigated, and some is not, serving largely as pasture until the sod is harvested. This second type of sod is a "crop of opportunity" and is irrigated only prior to sale. Since the objective here is to project actual irrigation requirements, only regularly irrigated sod is addressed. Estimates of irrigated sod acreage were made using the District's water use permits and GIS land maps.

In 2000, there were a total of 2,950 acres of irrigated sod production in the planning area, with an estimated irrigation requirement of 9.1 MGD. Sod production is projected to remain at its 2000 acreage through 2025.

Greenhouse/Nursery

Varieties of greenhouse and nursery crops are grown within the Kissimmee Basin. Historical commercial nursery acreage data for each county were used to make projections using functional forms that correlated nursery acreage with a time trend variable. Historical commercial nursery acreage data were gathered from annual volumes of the Florida Department of Agricultural and Consumer Services, Division of Plant Industry's Annual Reports (FDACS 1996–2003).

In addition to nursery plants, there is also a region within the Kissimmee Basin that uses land to produce caladium bulbs. Future acreages of caladium bulbs were projected based on input from the local IFAS extension office.

In 2000, there were 3,160 acres of greenhouse/nursery operations in the planning area, and this is projected to increase to 4,247 acres by the year 2025. Average demands

by nurseries in the planning area are projected to increase from 7.2 MGD in 2000 to 9.7 MGD in 2025.

Pasture

Improved pasture is defined by the SFWMD as pasture that has the facilities in place to carry out irrigation. There are about 200,000 acres encompassed in water use permits issued by the SFWMD for pasture irrigation in the KB Planning Area in 2004. Irrigation of pasture lands is believed to be limited and based more on sales opportunities and extreme drought maintenance, and not as part of regular crop maintenance. The water supply planning assumption that improved pasture is not irrigated does not preclude ranchers from acquiring SFWMD consumptive use permits or carrying out pasture irrigation

Miscellaneous

Cattle Watering

Demand for cattle watering and barn washing is associated with cattle production (which is in turn associated with pasture acreage). Water required for cattle watering was calculated as a function of the number and type of cattle (beef or dairy). Cattle numbers for 2000 were obtained from Florida Agricultural Statistics Services.

Aquaculture

Aquaculture (fish farming) withdraws water for circulation purposes and to replace evaporative losses. Withdrawals to replace evaporative losses are approximately 1.5 MGD, and were determined from existing consumptive use permits.

Demand Projections

Citrus

Historical citrus acreage data (**Table 13**) were gathered from volumes of the Commercial Citrus Inventory (FASS 2002–2004a).

Projected citrus acreage is shown in **Table 14**. Statistical methods were used to project county-level citrus acreage. The proportions of crop acreages for counties within the Kissimmee Basin were kept constant through 2025.

In Orange, Polk and Highlands counties citrus acreage was projected using log damped trend exponential smoothing. Time series data at two-year increments were used to estimate the damped trend exponential smoothing model. Citrus acreage in Osceola County was projected using robust regression. In northern Glades County, citrus acreage is expected to remain constant.

Table 15 shows the projected irrigation demands associated with the 2000 and projected citrus acreages in each county.

Table 13. Historical Citrus Acreage Countywide.

Year	Orange County	Osceola County	Polk County	Glades County	Okeechobee County	Highlands County
1966	65,817	18,921	149,287	1,413	2,508	37,409
1968	68,005	19,363	150,249	1,461	3,329	39,110
1970	65,961	19,051	150,122	1,572	3,597	38,803
1972	65,067	11,587	144,153	1,639	3,676	37,765
1974	56,320	17,115	141,475	1,661	4,087	37,996
1976	54,007	16,922	137,693	1,615	4,162	37,375
1978	51,174	16,231	134,261	1,613	4,171	37,105
1980	50,673	16,457	132,124	3,395	4,281	37,767
1982	48,547	17,959	133,545	4,026	6,954	37,661
1984	16,670	16,133	129,912	5,141	8,044	44,030
1986	14,692	13,035	106,993	6,076	7,449	46,012
1988	17,356	14,114	108,546	6,235	8,124	48,569
1990	8,399	16,101	99,718	7,523	8,541	57,048
1992	9,470	15,625	91,899	9,136	10,439	62,217
1994	10,402	15,654	104,007	9,270	11,270	74,035
1996	10,029	15,404	103,884	9,402	12,206	76,586
1998	9,188	15,535	102,457	10,776	12,244	75,909
2000	8,095	10,090	101,484	10,506	12,170	78,132
2002	6,884	7,964	100,202	10,384	12,035	77,391

Table 14. Projected Citrus Acreage Countywide and in Portions of Counties within the Kissimmee Basin Planning Area*.

County	Year						
	2000	2002	2005	2010	2015	2020	2025
Orange	8,095	6,884	5,563	4,204	3,172	2,368	1,753
Southern Orange*	4,497	3,824	3,090	2,336	1,762	1,316	914
Osceola	10,090	7,964	7,893	7,777	7,666	7,560	7,458
Western Osceola*	9,333	7,367	7,301	7,193	7,091	6,993	6,899
Polk	101,202	100,202	98,086	93,545	89,314	85,345	81,639
Eastern Polk*	2,537	2,505	2,452	2,339	2,233	2,134	2,041
Glades	10,506	10,384	10,384	10,384	10,384	10,384	10,384
Northern Glades*	5,043	4,984	4,984	4,984	4,984	4,984	4,984
Okeechobee	12,170	12,035	12,878	14,831	16,214	17,587	18,134
Western Okeechobee*	3,408	3,370	3,606	4,143	4,540	4,924	5,078
Highlands	78,131	77,391	76,345	76,105	77,011	75,917	75,882
Eastern Highlands*	27,346	27,087	26,721	26,637	26,954	26,571	26,559

*Note: The following portions of citrus acreage are within the Kissimmee Basin: 55.5% of the acreage within Orange County; 92.5% of the acreage within Osceola County; 2.5% of the acreage within Polk County; 48% of the acreage within Glades County, 28% of the acreage within Okeechobee County and 35% of the acreage within Highlands County.

Table 15. Irrigation Requirements for Projected Citrus Acreage.

County/Acreage/Demand	2000	2005	2010	2015	2020	2025
Southern Orange County						
Acreage	Acres					
Irrigated Acreage	4,497	3,090	2,336	1,762	1,316	974
Net Irrigation Requirements	MGD					
Annual Based on Average Rainfall Year (9.92 in.)	4.34	2.98	2.26	1.70	1.27	0.94
Annual Based on 1-in-10 Rainfall Year (22.00 in.)	9.62	6.61	5.00	3.77	2.82	2.09
Western Osceola County						
Acreage	Acres					
Irrigated Acreage	9,333	7,301	7,193	7,091	6,993	6,899
Net Irrigation Requirements	MGD					
Annual Based on Average Rainfall Year (8.13 in.)	7.19	5.62	5.54	5.46	5.39	5.32
Annual Based on 1-in-10 Rainfall Year (19.76 in.)	17.48	13.67	13.47	13.28	13.10	12.92
Eastern Polk County						
Acreage	Acres					
Irrigated Acres	2,537	2,452	2,339	2,233	2,134	2,041
Net Irrigation Requirements	MGD					
Annual Based on Average Rainfall Year (11.58 in.)	2.63	2.55	2.43	2.32	2.22	2.18
Annual Based on 1-in-10 Rainfall Year (22.70 in.)	5.16	4.99	4.76	4.54	4.34	4.15
Eastern Highlands County						
Acreage	Acres					
Irrigated Acreage	27,346	26,721	26,637	26,954	26,571	26,559
Net Irrigation Requirements	MGD					
Annual Based on Average Rainfall Year (12.11 in.)	30.42	29.72	29.63	29.98	29.56	29.54
Annual Based on 1-in-10 Rainfall Year (26.00 in.)	65.31	63.81	63.61	64.37	63.45	63.43

Table 15. Irrigation Requirements for Projected Citrus Acreage (Continued).

County/Acreage/Demand	2000	2005	2010	2015	2020	2025
Northern Glades County						
Acreage	Acres					
Irrigated Acreage	5,043	4,984	4,984	4,984	4,984	4,984
Net Irrigation Requirements	MGD					
Annual Based on Average Rainfall Year (14.20 in.)	7.50	7.42	7.42	7.42	7.42	7.42
Annual Based on 1-in-10 Rainfall Year (28.01in.)	14.80	14.63	14.63	14.63	14.63	14.63
Western Okeechobee County						
Acreage	Acres					
Irrigated Acreage	3,408	3,606	4,153	4,540	4,924	5,078
Net Irrigation Requirements	MGD					
Annual Based on Average Rainfall Year (12.33 in.)	3.84	4.06	4.67	5.11	5.54	5.71
Annual Based on 1-in-10 Rainfall Year (25.21 in.)	7.84	8.30	9.56	10.45	11.33	11.69

Vegetables, Melons and Berries

Vegetable crops were grouped together for projection purposes. This was warranted by the lack of significant difference between the irrigation requirements of the different types of vegetables cultivated in the KB Planning Area, and the production practices used on vegetable farms (different types of vegetables are sometimes grown interchangeably). Vegetables in the KB Planning Area are grown commercially in Osceola, Polk, Highlands, Glades and Okeechobee counties.

Vegetable fields are planted and harvested sequentially, and some portion of the total acreage used for vegetable production is commonly vacant. This temporal area of vegetable land vacancy effects total irrigation requirements, but it is difficult to quantify. Production timing may change for several reasons. For example, growers may enter into a contract to harvest vegetables in a specific time window, which would in turn determine their growing season. In addition, as seepage irrigation is the predominant type of irrigation system used for vegetable production, some of these vacant fields are unavoidably irrigated, either in part or completely. With these constraints in mind, cultivation schedules were developed to calculate irrigation requirements.

In addition to vegetable crops (which typically use seepage irrigation systems), there are also about 200 acres of blueberries (on microirrigation) in eastern Highlands County. **Table 16** outlines the seasonal vegetable and blueberry acreage and irrigation

requirements in the KB Planning Area, and **Table 17** shows blueberry irrigation demands.

Table 16. Irrigation Requirements for Projected Vegetable Acreage.

County	2000 Irrigated Acreage	Average		1-in-10	
		Net Irr. Req. (in.)	MGD	Net Irr. Req. (in.)	MGD
Western Osceola	2,432	10.0	3.62	13.2	4.78
Eastern Polk	588	9.6	0.84	12.3	1.08
Eastern Highlands	3,445	10.4	5.33	13.7	7.02
Northern Glades	1,248	11.3	2.10	13.8	2.56
Western Okeechobee	4,977	13.3	9.45	13.3	9.45
Southern Orange	0	0.0	0.00	0.0	0.00

Table 17. Irrigation Requirements for Blueberry Acreage in Eastern Highlands County.

County	2000 Irrigated Acreage	Average		1-in-10	
		Net Irr. Req. (in.)	MGD	Net Irr. Req. (in.)	MGD
Eastern Highlands	200	12.2	0.21	26.0	0.45

Field Crops

Field crops grown within the SFWMD include sugarcane, rice, seed corn, soybean and sorghum. Sugarcane is one of the largest commercially grown field crops in the Kissimmee Basin. Historically, sugarcane was produced in northern Glades County, but recently about 300 acres were planted in Highlands County.

Sugarcane is initially propagated by planting stalk cuttings. The first harvest takes place approximately 13 months after planting. Sugar production per unit of land surface declines gradually with each additional rotation and in approximately four years (one planting and three ratoons) the increased yields associated with replanting outweigh the costs. Because land may lay fallow for several months between crop rotation cycles, approximately 20 percent of the land associated with sugarcane production will not be reported as production by the Florida Agricultural Statistics Service. This land does not require irrigation and is not included in these projections.

Table 18 presents historical sugarcane acreage data gathered from annual volumes of the Field Crops Summary (FASS 2002–2004b). There has been some fluctuation in sugarcane acreage in Glades County. Discussions with local growers and extension agents suggest that 2000 acres of growth is expected by 2025. This acreage has been distributed equally among Glades and Highlands counties. **Table 19** shows the

mean and 1-in-10 year drought irrigation requirements for sugarcane in Glades and eastern Highlands counties.

While sugarcane is the single largest field crop within the KB Planning Area, other field crops including rice, seed corn, soybean and sorghum are grown in the region. The SFWMD used aerial photography and satellite imagery to estimate the acreages. In 2000, the acreage associated with rice, seed corn, soybean, sorghum and similar crops totaled 2,401 within the KB Planning Area. The future acreage of these crops is expected to remain at the 2000 levels.

Table 18. Historical Sugarcane Acreage in Glades County.

Year	Glades County
1975	16,636
1976	18,545
1977	16,842
1978	18,260
1979	19,454
1980	20,096
1981	22,908
1982	22,904
1983	22,924
1984	26,015
1985	15,599
1986	17,165
1987	20,020
1988	20,321
1989	20,119
1990	19,633
1991	19,633
1992	19,633
1993	19,633
1994	19,633
1995	19,633
1996	19,633
1997	19,633
1998	19,633
1999	20,942
2000	19,633

Table 19. Irrigation Requirements for Projected Sugarcane Acreage in the Kissimmee Basin.

	Northern Glades County			Eastern Highlands County	
	2000		2005–2025	2005–2025	
Irrigated Acreage	3,338		4,438	1,000	
Irrigation Requirements	Net Irr. Req. (in.)	MGD	MGD	Net Irr. Req. (in.)	MGD
Average	20.2	10.02	13.32	13.3	1.98
1-in-10	26.3	13.04	17.33	17.9	2.66

Sod

The sod projections presented here refer to irrigated sod. There is additional sod harvested from pastureland, which is not irrigated. Sod in the KB Planning Area is grown commercially in Osceola, Polk, Highlands, Glades and Okeechobee counties. **Table 20** presents irrigation requirements for projected sod acreage in the Kissimmee Basin.

Table 20. Irrigation Requirements for Projected Sod Acreage in the Kissimmee Basin.

County	Irrigated Acreage	Average		1-in-10	
		Net Irr. Req. (in.)	MGD	Net Irr. Req. (in.)	MGD
Western Osceola	500	20.5	1.53	23.4	1.74
Eastern Polk	1000	20.0	2.98	30.7	4.55
Eastern Highlands	900	20.8	2.79	33.7	4.51
Northern Glades	300	22.8	1.02	36.6	1.63
Western Okeechobee	250	20.3	0.76	26.4	0.98
Southern Orange	0	17.9	0.00	22.2	0.00

Greenhouse/Nursery

Ornamental nurseries within the KB Planning Area are found in Orange, Osceola, Highlands and Okeechobee counties. Highlands County also has a significant amount of caladium farm acreage, which has been grouped under this nursery category.

Orange County ornamental nursery acreage has increased relatively steadily despite minor declines that occurred in the aftermath of major freezes. Overall, the trend of ornamental nursery acreage has been upward at a rate of approximately 40 acres per year countywide, with a slightly increased rate per year for the last ten years. The linear exponential smoothing statistical model was selected to project ornamental acreage. This model extrapolates an increase of about 50 acres of nurseries per year in Orange County. An estimated 25 percent of this nursery acreage increase is anticipated to be within the SFWMD. This increase was kept constant throughout the projection period.

All nursery acreage in Osceola County is within the Kissimmee Basin Planning Area (western Osceola County). County ornamental nursery acreage peaked at 271 acres in 1998. Since 1998, Osceola nursery acreage has declined slightly. A damped trend exponential smoothing model was estimated and a slight long-term decline in nursery acreage from about 246 acres to a long-term acreage of about 232 acres was projected.

Highlands County ornamental nursery acreage has increased rapidly since about 1990. In 1991, there were 166 acres of ornamental nurseries. By 1993, the ornamental acreage increased to 1,349 acres, and by 2000, the acreage increased to 2,226 acres. A linear exponential smoothing model gave the best fit to the observed acreage. This model projects ornamental nursery acreage in Highlands County to increase to 4,449 acres by 2025. This represents slightly less than a doubling of ornamental nursery acreage from its 2000 level. About 20 percent of the ornamental nursery acreage in Highlands County (eastern Highlands County) is within the Kissimmee Basin, and the increase was kept constant throughout the projection period.

Eastern Highlands County also has a significant acreage of caladiums, producing over 90 percent of the world's caladium bulbs. The production area is within the KB Planning Area, located just south of Lake Istokpoga. The acreage used by the caladium industry has stabilized between 1,200 and 1,500 acres, and is projected to remain relatively constant through 2025. This acreage is not included as nursery acreage by the FDACS Division of Plant Industry Annual Reports (FDACS various issues). **Table 21** shows demands for 1,500 acres of caladiums included with greenhouse/nursery acreage demands.

All nursery acreage in Okeechobee County is within the Kissimmee Basin (western Okeechobee County). Since the 1990s, Okeechobee County ornamental nursery acreage has increased relatively steadily at a rate of about 20 acres per year, reaching 815 acres in 2000. The statistical model with a best-fit linear projection was used to estimate acreage for 2025.

Table 22 summarizes the estimated greenhouse/nursery acreage and irrigation requirements for each of the counties within the KB Planning Area. The portion of each county's total acreage that falls within the KB Planning Area is estimated at 25 percent for Orange County; 100 percent for Osceola County; 60 percent; for Highlands County and 100 percent for Okeechobee County.

Table 21. Historical and Projected Greenhouse/Nursery Acreage Countywide and within Portions of Counties in the Kissimmee Basin.

Year	Historical Orange County Acreage	Projected Orange County Acreage	Historical Osceola County Acreage	Projected Osceola County Acreage	Historical Highlands County Acreage	Projected Highlands County Acreage	Historical Okeechobee County Acreage	Projected Okeechoee County Acreage
1972	682		30				5	
1973	711		29				4	
1974	688		29				6	
1975	922		30		167		5	
1976	842		20		171		6	
1977	907		22		173		6	
1978	946				144		7	
1979	985		24		152		8	
1980	985		35		159		48	
1981	1,097		166		229		40	
1982	1,155		191		180		16	
1983	1,187		200		185		18	
1984	1,090		230		202		20	
1985	1,110		204		216		29	
1986	1,203		358		435		36	
1987	1,319		329		272		159	
1988	1,183		461		187		20	
1989	1,285		498		281		74	
1990	1,312		477		176		86	
1991	1,224		365		166		241	
1992	1,261		350		168		491	
1993	1,292		168		1,349		494	
1994	1,338		113		1,577		452	
1995	1,307		106		1,587		714	
1996	1,428		168		1,627		730	
1997	1,550		229		1,667		746	
1998	1,636		267		1,778		680	
1999	1,689		271		1,882		787	
2000	1,806	1,806	248	248	2,226	2.226	815	815
2005		2,043		199		2,879		912
2010		2,214		199		3,272		1,009
2015		2,385		198		3,664		1,107
2020		2,555		198		4,057		1,204
2025		2,626		198		4,449		1,302

Table 22. Irrigation Requirements for Projected Greenhouse/Nursery Acreage in the Kissimmee Basin.

County/Acreage/Demand	2000	2005	2010	2015	2020	2025
Southern Orange County						
Acreage	Acres					
Irrigated Acres	452	511	554	596	639	657
Net Irrigation Requirements	MGD					
Annual Based on Average Rainfall Year (20.8 in.)	0.93	1.05	1.14	1.23	1.32	1.36
Annual Based on 1-in-10 Rainfall Year (25.0 in.)	1.12	1.27	1.38	1.48	1.58	1.63
Western Osceola County						
Acreage	Acres					
Irrigated Acres	248	199	199	198	198	198
Net Irrigation Requirements	MGD					
Annual Based on Average Rainfall Year (23.4 in.)	0.58	0.46	0.46	0.46	0.46	0.46
Annual Based on 1-in-10 Rainfall Year (27.5 in.)	0.68	0.54	0.54	0.54	0.54	0.54
Eastern Highlands County						
Acreage	Acres					
Irrigated Acres	1,645	1,776	1,854	1,933	2,011	2,090
Net Irrigation Requirements	MGD					
Annual Based on Average Rainfall Year (23.52 in.)	3.84	4.14	4.32	4.51	4.69	4.87
Annual Based on 1-in-10 Rainfall Year (28.0 in.)	4.57	4.93	5.15	5.37	5.59	5.81
Western Okeechobee County						
Acreage	Acres					
Irrigated Acres	815	912	1,009	1,107	1,204	1,302
Net Irrigation Requirements	MGD					
Annual Based on Average Rainfall Year (23.3 in.)	1.88	2.10	2.33	2.56	2.78	3.01
Annual Based on 1-in-10 Rainfall Year (29.1 in.)	2.35	2.63	2.91	3.19	3.48	3.76

Improved Pasture

Improved pasture is pasture that has the facilities in place to carry out irrigation. Unless there is evidence of active pasture irrigation within a specific county, the irrigation of that acreage is not included in the primary projection scenario analyzed in the District's regional water supply plans. Although this assumption may not be the case in some rare instances, it is much closer to actual production practices than the values given by any irrigation requirement model or permit.

The water supply planning assumption that improved pasture is not irrigated does not preclude ranchers from acquiring SFWMD consumptive use permits, or carrying out pasture irrigation; however, this irrigation activity is not part of the primary projection for irrigation demand in a mean or 1-in-10 year drought.

Cattle Watering

Water required for cattle watering was assessed as a function of the number of and type (beef or dairy) of cattle. Demand projections for cattle watering (**Table 23**) were based on the SFWMD allocation of 12 gallons/cow/day for beef cattle and 150 gallons/cow/day for dairy cattle. Demand was assessed at 9.6 MGD in 2000 and is projected to remain stable through 2025.

Table 23. Cattle Watering Demands in the Kissimmee Basin Planning Area.

County Area	Total Non-Dairy Cattle	Dairy Cows	Total Cattle and Calves	MGY	MGD
Southern Orange	1,700	0	1,700	7	0.02
Western Osceola	62,400	0	62,400	273	0.75
Eastern Polk	35,343	500	35,843	182	0.50
Eastern Highlands	88,800	7,000	101,369	772	2.11
Northern Glades	50,692	0	50,692	222	0.61
Western Okeechobee	86,870	30,600	147,050	2,056	5.63
Total	325,805	38,100	399,054	3,512	9.62

Aquaculture

Aquacultural operations withdraw water for circulation and replace evaporative losses. Replacement quantities, outlined in **Table 24**, were assessed for counties with currently permitted consumptive uses for aquaculture (fish farming). There are no existing consumptive use permits for aquaculture in southern Orange or northern Glades counties. Demands are projected to remain at a constant level through 2025.

Table 24. Aquaculture Demands in the Kissimmee Basin Planning Area.

County Area	MGY	MGD
Western Osceola	203	0.55
Eastern Polk	2	0.01
Eastern Highlands	114	0.31
Western Okeechobee	229	0.63
Total	548	1.50

Total Irrigated Acreage

Table 25 presents irrigated agricultural acreages for the KB Planning Area.

Table 25. Irrigated Agricultural Acreage in the KB Planning Area.

Category	Southern Orange County	Western Osceola County	Eastern Polk County	Eastern Highlands County	Northern Glades County	Western Okeechobee County	Total KB	% of Total
2000								
Citrus	4,497	9,333	2,537	27,346	5,043	3,408	52,164	70.0%
Vegetables, Melons and Berries	0	2,432	588	3,645	1,248	4,977	12,890	17.3%
Field Crops (Sugarcane)	0	0	0	0	3,338	0	3,338	4.5%
Sod	0	500	1,000	900	300	250	2,950	4.0%
Greenhouse/Nursery	452	248	0	1,645	0	815	3,160	4.2%
Total	4,949	12,513	4,125	33,536	9,929	9,450	74,502	100.0%
2025								
Citrus	974	6,899	2,041	26,559	4,984	5,078	46,535	64.4%
Vegetables, Melons and Berries	0	2,432	588	3,645	1,248	4,977	12,890	17.8%
Field Crops (Sugarcane)	0	0	0	1,000	4,438	0	5,438	7.5%
Sod	0	500	1,000	900	300	250	2,950	4.0%
Greenhouse/Nursery	657	198	0	2,090	0	1,502	4,447	6.2%
Total	1,631	10,029	3,629	34,194	10,970	11,807	72,260	100.0%

Total Annual Water Demand

Table 26 shows estimated 2000 and projected 2025 demands for the KB Planning Area.

Table 26. SFWMD Overall Water Demands for 2000 and 2025 (MGD).

Water Use Category	Average Demands 2000 (MGD)	Average Projected Demands 2025 (MGD)	% Change Average Demands 2000–2025	1-in-10 Projected Demand 2025
Public Water Supply	117.41	236.65	102%	251.76
Domestic Self-Supply	10.60	14.70	39%	15.62
Commercial & Industrial Self-Supply	13.83	24.71	79%	24.71
Recreational Self-Supply	5.71	15.13	165%	18.66
Thermoelectric Power Generation Self-Supply	0.46	22.46	48%	22.46
Agricultural Self-Supply	114.75	117.86	3%	190.52
Total Water Demands	262.76	431.51	64%	524.18

Summary of 1-in-10 Water Demands

The demand estimates summarized thus far have been presented for average water use conditions. However, the water supply plan requirements call for a level of certainty in the plan under a 1-in-10 year drought condition. In most instances the 1-in-10 year drought water demands are higher than in the average water use. For PWS and domestic self-supplied use, drought conditions are represented by a use that is 6 percent higher than the average demands. Estimated 1-in-10 year drought demands for PWS and domestic self-supply is 251.76 MGD for 2025. Agricultural 1-in-10 year drought demands can be significantly higher than average conditions depending on soil and crop type. Agricultural 1-in-10 year drought demands for 2025 are 190.5 MGD, 61 percent higher than average conditions. Recreational use has similar differences between average drought demand estimates. Only commercial/industrial use and power generation (electric) are estimated to show little difference between average and 1-in-10 year drought conditions. Total water use under 1-in-10 year drought conditions is estimated at 340.7 MGD for the year 2000 and 524.18 MGD for the year 2025.

Changes from the 2000 KB Water Supply Plan

There were several changes made in the demand assessment and projection methodology from the 2000 KB Plan to the 2005 KB Update. These are summarized below:

Census blocks used instead of Census block groups. The population analysis conducted in this 2005 KB Update used census blocks; whereas block groups were used 2000 KB Plan. A Census block is the smallest Census geographic area, normally bounded by streets and other prominent physical features. A Census block has a higher resolution than a group of blocks (Census block group), therefore, use of blocks rather than block groups provide a higher level of precision.

A decreased water use threshold for public water supply utilities from 500,000 to 100,000 gallons per day. This had the effect of increasing the number of PWS utilities analyzed in the 2005 KB Update.

Supplemental irrigation needs determined using the AFSIRS model versus a modified Blaney-Criddle model. Both of these models estimate evapotranspiration (ET) in order to derive supplemental irrigation requirements for agricultural crops and outdoor irrigation. However, in south Florida, the Blaney-Criddle model tends to overestimate ET, which is the driving component of supplemental irrigation. As a result, the Blaney-Criddle model has the potential to overestimate supplemental irrigation requirements. To address this, District staff began using the Agricultural Field Scale Irrigation Requirement Simulation (AFSIRS) model as the regional water supply plans were updated. The AFSIRS model yields supplemental irrigation requirements that better reflect historic use patterns, and are generally lower than the modified Blaney-Criddle model on an annual basis.

Comparison with 2000 Kissimmee Basin Projected Water Demands

Table 27 shows the estimated average water demands estimated in the 2000 Kissimmee Basin Water Supply Plan (KB Plan) and those estimated for the 2005 KB Update. **Table 28** presents the 1-in-10 estimated demands in the 2000 KB Plan and those estimated for this update.

Table 27. Estimated Average Water Demands in the 2000 Kissimmee Basin Water Supply Plan and 2025 Update.

Water Use Category	2000 KB Plan Average Demands for 2020 (MGD)	2005 KB Plan Average Demands for 2025 (MGD)	% Change 2000 KB Plan (2020) vs. 2005 KB Update (2025)
Public Water Supply	145.30	236.65	63%
Domestic Self-Supply and Small Public Supply Systems	11.80	14.70	25%
Commercial & Industrial Self-Supply	5.80	24.71	326%
Recreational Self-Supply	23.82	15.13	-37%
Thermoelectric Power Generation Self-Supply	0.46	22.46	4782%
Agricultural Self-Supply	476.70	117.86	-75%
Total Water Use	663.88	431.51	-35%

Table 28. Estimated 1-in-10 Demands in the 2000 Kissimmee Basin Water Supply Plan and 2025 Update.

Water Use Category	2000 KB Plan 1-in-10 Demands for 2020 (MGD)	2005 KB Plan 1-in-10 Demands for 2025 (MGD)	% Change 2000 KB Plan (2020) vs. 2005 KB Update (2025)
Public Water Supply	154.02	251.76	74%
Domestic Self-Supply and Small Public Supply Systems	12.51	15.62	25%
Commercial & Industrial Self-Supply	5.80	24.71	326%
Recreational Self-Supply	27.39	18.66	-32%
Thermoelectric Power Generation Self-Supply	0.46	22.46	4782%
Agricultural Self-Supply	566.00	190.52	-66%
Total Water Use	766.18	524.18	-30%

For public water supply and domestic self-supply, 1-in-10 demand projections are believed to be 6 percent greater than average demand projections.

Differences are seen between the previous (2000) KB Plan demand estimates and those estimated for this 2005 plan update for the following reasons:

- Agricultural acreage growth trends (particularly citrus in the south of the KB) have leveled off. This was not the observed trend at the time of the 2000 KB Plan. For example, the projection for irrigated agricultural acreage in the 2000 KB Plan anticipated a significant increase in citrus acreage (the dominant crop in the region), whereas the 2005 KB Update anticipates a modest decline.
- At the time of the development of the 2000 KB Plan there were several agricultural corporations in the region that expressed significant expansion plans for crops that would require irrigation; however, these plans were not fully acted upon.
- The irrigation model used in the 2000 KB Plan was a modified Blaney-Criddle model, whereas the AFSIRS model is used for the 2005 KB Update. Use of that version of the Blaney-Criddle model generally results in a higher per acre irrigation than AFSIRS.

REFERENCES CITED

Bureau of Economic and Business Research (BEBR). 2004. *Projections of Florida Population by County 2004–2030*. BEBR, University of Florida, Gainesville, FL.

National Golf Foundation. 2001. *Golf Course Directory, Volume I.* National Golf Foundation, Jupiter, FL. vari. pag.

Florida Department of Agriculture and Consumer Services. 1996–2003. *Division of Plant Industry Annual Reports*. FDACS, Gainesville, FL. vari. iss. Available from: http://doacs.state.fl.us/pi/

Florida Agricultural Statistics Service (FASS). 2002–2004a. *Commercial Citrus Inventory*. FASS, Orlando, FL. vari. iss. Available from: http://www.nass.usda.gov/fl.

Florida Agricultural Statistics Service (FASS). 2002–2004b. *Field Crops Summary*. FASS, Orlando, FL. vari. iss. Available from: http://www.nass.usda.gov/fl.

Florida Agricultural Statistics Service (FASS). 2002–2004c. *Vegetable Summary*. FASS, Orlando, FL. vari. iss. Available from: http://www.nass.usda.gov/fl.

South Florida Water Management District. 2000. *Kissimmee Basin Water Supply Plan – Appendices, Appendix F*. Water Supply Department, SFWMD, West Palm Beach, FL. Available from: http://www.sfwmd.gov.

United States Bureau of Census. 2001. *Florida 2000 Census of Population and Housing*. U.S. Department of Commerce, Washington, D.C. Available from: http://www.census.org.

United States Geological Survey. 2003. *USGS Water Use Data: 2000 Water Use Data for Florida by Category, County and Water Management District with Historical Tables by County and Water Management District.* February 10, 2003. USGS, Tallahassee, FL.